5.0 STUDY AREA NO. 2

Study Area No. 2 consists of AOC-2 (Naphthalene-Contaminated Soil) and SWMU Nos. 11 (Past Landfill Area A), 12 (Past Landfill Area B), and 42 (Former Creekbed).

5.1 DESCRIPTION

5.1.1 AOC-2: Naphthalene-Contaminated Soil

Approximately 840 cubic yards of soil was excavated and removed from this area. Based on visual and odor observations, it was believed that the excavated soil was contaminated by naphthalene (NUS, 1991). The area is now covered partly by cement and partly by gravel.

5.1.2 SWMU 11: Past Landfill Area A

This area was formerly used for temporary waste storage. It was an unlined excavation basin that has since been paved. Approximately 700 tons of mother liquor (approximately 15 percent maleic acid, 3 percent phthalic acid, and 82 percent water) were reportedly stored in the landfill. All visible wastes were reportedly removed before the area was capped with asphalt (NUS, 1991).

5.1.3 SWMU 12: Past Landfill Area B

This area may have been used for the temporary storage of phthalic acid mother liquor or for tar acid, naphthalene, and tar base sludge disposal. The history of this SWMU is uncertain (NUS, 1991).

5.1.4 SWMU 42: Former Creekbed

The Frankford Creek meander was filled in at some time between 1950 and 1957. The fill material, which may have included coal-tar-like materials, incinerator ash, phthalates, or phenol-formaldehyde resins, has been partly excavated. Sections of it are paved over or covered by the refined acetone tank farm (NUS, 1991).

5.2 INVESTIGATION

5.2.1 Previous Investigations

No chemical analyses of environmental samples were performed prior to the Phase I RFI at AOC-2 or the three SWMUs that make up Study Area No. 2. Previous visual and odor observations indicated possible naphthalene contamination in excavated soil from AOC-2 and suspected naphthalene, coal-tar residue, formaldehyde, and carbolic oil contamination in excavated soil from SWMU No. 42 (NUS, 1991).

5.2.2 RFI Phase I Investigations

5.2.2.1 AOC-2: Naphthalene-Contaminated Soil

Three soil borings (40, 41, and 51) were advanced in AOC-2. A vadose zone sample from each boring was analyzed for the following parameters:

- TCL VOA
- TCL BNA
- AMS and cumene
- TOC
- Grain size (one sample)

5.2.2.2 SWMU 11: Past Landfill Area A

Five soil borings (45, 46, 47, 48, and 49) were advanced in SWMU No. 11. A vadose zone sample from each boring was analyzed for the following parameters:

- TCL VOA
- TCL BNA
- AMS and cumene
- TOC

5.2.2.3 SWMU 12: Past Landfill Area B

Five soil borings (24, 25, 26, 50, and 56) were advanced in SWMU No. 12. A vadose zone sample from each boring was analyzed for the following parameters:

- TCL VOA
- TCL BNA
- AMS and cumene
- TOC
- Grain size (one sample)

5.2.2.4 SWMU 42: Former Creekbed

Originally, five soil borings (10, 19, 33, 34, and 53) were intended to characterize creekbed fill and two soil borings (17 and 18) were designed to characterize fill surrounded by the former creekbed meander. Because fill is widespread throughout Study Area No. 2 and no apparent contrasts between the boring sets were observed, all seven borings will be considered for the discussion of SWMU No. 42. A vadose zone sample from each boring was analyzed for the following parameters:

- TCL VOA
- TCL BNA
- AMS and cumene
- TOC

5.3 SITE CHARACTERISTICS

5.3.1 Geology

Boring nos. 45, 46, 47, 48, and 49 were drilled to investigate SWMU No. 11, Past Landfill Area A, in Study Area No. 2. The fill deposits at SWMU No. 11 are approximately seven to nine or more feet thick (see Figure 3-5). The fill is composed primarily of silt, clay, sand, gravel, and rock fragments, with some ash or ashy material and coal. In soil boring nos. 47 and 49, several feet of hard material containing sand, gravel, and rock fragments, which had the appearance of improperly mixed or very decomposed concrete, were penetrated. The surface of SWMU No. 11 surrounding the truck scale is covered by about 12 inches of asphalt, with gravel base material.

Sample descriptions indicate that the fill deposits at SWMU No. 11 are underlain by the silt-clay lithologic unit (see Figure 3-7). It is not possible to determine the thickness of the silt-clay unit or the presence of the lower sand and gravel lithologic unit from the available information. The depth to saprolite and bedrock at SWMU No. 11 is estimated to be between 30 and 40 feet below the surface.

Boring nos. 40, 41, and 51 were drilled to investigate AOC-2, the Naphthalene-Contaminated Soils, in Study Area No. 2. The fill deposits at AOC-2 are approximately 10 feet thick and consist largely of gravel, silt, clay, rock and brick fragments, ashy material, and some coal or coal-tar residue. A layer of white to brown solid crystalline material (primarily naphthalene) approximately 24 inches thick was found in boring no. 41. Small crystals of naphthalene-like material were found in the fill materials in boring no. 51. The surface at AOC-2 is covered by either asphalt, concrete, or crushed-stone gravel.

The fill deposits at AOC no. 2 are directly underlain by the silt-clay lithologic unit at a depth of about 10 feet. Approximately six feet of the lower sand and gravel lithologic unit underlies the silt-clay unit at a depth of about 35 feet. Saprolite and bedrock underlie the lower sand and gravel at a depth of 41 to 42 feet.

Boring nos. 24, 25, 26, 50, and 56 were drilled to investigate SWMU No. 12, Past Landfill Area B, in Study Area No. 2. The fill deposits at SWMU No. 12 range from approximately 9 to 20 feet thick and increase in thickness from north to south toward the filled channel of the former Frankford Creek (see Figure 3-5). The fill is composed primarily of sand, silt, clay, gravel, fragments of rock, brick and concrete, wood, ashy material, coal, and a black tarry sludge-like material.

The fill deposits at SWMU No. 12 are directly underlain by the silt-clay lithologic unit at a depth of about 9 feet in the northern part of the area and 20 feet or more in the southern part near the filled former creekbed. Available information (Cross-section B-B' -- see Figure 3.4) suggests that approximately six feet of the lower sand and gravel lithologic unit underlie the silt-clay deposits at a depth of about 35 feet. Saprolite and bedrock are expected to underlie the lower sand and gravel at a depth of about 41 to 42 feet. Boring nos. 10, 17, 18, 19, 33, 34, and 53 were drilled to investigate SWMU No. 42, the former creekbed, in Study Area No. 2. Boring nos. 10, 19, 33, and 34 were drilled in the former creekbed meander to investigate the nature of the fill materials. Boring no. 55 in Study Area No. 1 is also located within the former creekbed meander and provides additional information concerning the nature and thickness of the fill deposits in the area. Boring nos. 17 and 18 were drilled in the area surrounded by the former creekbed meander to establish baseline soil (or fill) conditions for comparison with the meander fill materials.

Boring no. 53 was drilled in the former Frankford Creek channel in the southwestern part of the site to compare the fill materials at this location with those of the meander. Study Area No. 1 soil boring nos. 27, 52, 58 and 59 and the MW-103 boring, Study Area No. 2 boring no. 42, and Study Area No. 3 boring no. 53 also provide some additional information concerning the nature and thickness of fill deposits in this portion of the creekbed.

The fill materials within the former creekbed meander and the area enclosed by the meander are very similar in terms of their composition. The principal components are clay, silt, sand, fragments of brick, rock, concrete or coal, ash, ashy material, gravel, and pebbles. Coal-tar-like residue was found in boring nos. 10, 17, and 34 of Study Area No. 2 and in boring no. 55 of Study Area No. 1. Fragments or crystals of material suspected to be naphthalene were found in boring nos. 18 and 33 of Study Area No. 2. A 14-inch-thick layer of naphthalene-like crystalline material was found in boring no. 55 of Study Area No. 1. Based on the results from boring no. 55, the fill reaches or exceeds a thickness of 20 feet along the axis of the former creekbed meander (see Figure 3-5). The fill deposits are approximately 7 to 10 feet thick in the area enclosed by the former creekbed meander.

The fill deposits of the former creekbed in the southwestern part of the site described in boring no. 53 consist primarily of clay, silt, sand, ash, and fragments of brick, rock, concrete, and coal. Smaller amounts of glass, wood, gravel, and metal debris are also present. Several of the Study Area Nos. 1, 2, and 3 soil borings within the former creekbed in the southern and southwestern parts of the site revealed very similar fill deposits. The principal exception to this occurs within the eastern half of this portion of the creekbed. Boring nos. 52 and 59 and the well boring for MW-103 each encountered a hard tar or asphalt-like layer at an approximate depth of 10 feet. The fill deposits in the southern and southwestern part of the filled former creekbed range in thickness from approximately 10 to 15 feet near the edges of the channel to as much as 20 feet or more near the axis of the former channel (see Figure 3-5).

The fill deposits throughout most of the former creekbed channel and meander are directly underlain by the silt-clay lithologic unit at depths of about 10 to 20 feet or more (see Figures 3-5 and 3-7). The principal exception to this occurs in Study Area No. 1 boring nos. 55 and 56. In boring no. 55, a layer of well-sorted sand approximately five feet thick occurs between the fill deposits and the silt-clay unit. In boring no. 56, some thin sandy layers are present between the fill deposits and the silt-clay unit. It is unclear whether these sands represent localized Recent deposits within the former Frankford Creek channel, misinterpreted fill deposits, or thin portions of the upper sand and gravel lithologic unit. In any case, they are still underlain by the silt-clay deposits. The silt-clay unit underlying the former creekbed is expected to be underlain by approximately 6 feet of the lower sand and gravel lithologic unit, with the possible exception of the area including the northwestern part of the former creekbed meander (see Cross-sections A-A' and B-B' -- Figures 3-3 and 3-4). Saprolite and bedrock underlie either the lower sand and gravel or the silt-clay unit (where the lower sand and gravel is not present) at approximate depths of 35 to 40 feet.

5.3.2 Hydrogeology

The depth to the saturated zone in soil borings within the former creekbed channel and meander ranges from approximately 3 to 9 feet below the surface and averages about 5 feet below the surface. In all cases, the shallow aquifer occurs within the fill deposits. It is possible that the upper sand and gravel unit also comprises part of the shallow aquifer in the northernmost part of the former creekbed meander, based on information from MW-101 (Section 3.5.2.2). The silt-clay unit underlying the shallow aquifer throughout the area of the former creekbed is expected to act as a lower confining layer, restricting the downward movement of groundwater from the shallow aquifer.

Specific hydrologic information is available in only limited areas of SWMU No. 42. Piezometers P-2 through P-5 and recovery wells R-1 through R-3 are located within, or very close to, the western part of the former creekbed meander (see Figure 3-8). A wide range of groundwater elevations is observed: from 6.89 feet above mean sea level in P-5 to 3.81 feet below mean sea level in active recovery well R-2.

Steep hydraulic gradients and shallow groundwater flow toward recovery wells R-2 and R-3 are observed in a small localized area around the recovery wells. Shallow groundwater along the western boundary of the meander is interpreted to flow generally toward the west. The present distribution of piezometers and recovery wells is not sufficient to determine the accurate direction of shallow groundwater flow throughout the entire area. The effects of rising and falling tides in the Frankford Inlet and the pumping cycles of recovery wells R-2 and R-3 cannot be determined from the available data.

The general direction of shallow groundwater flow is inferred to be toward the west along the northern edge of the former Frankford Creek channel between the meander and the location of MW-103 (see Figure 3-8). The lowest measured equilibrium groundwater elevation within the Frankford Plant, 1.39 feet above mean sea level, was recorded in MW-103. It is not possible to determine the shallow groundwater elevation or flow direction south or west of this area.

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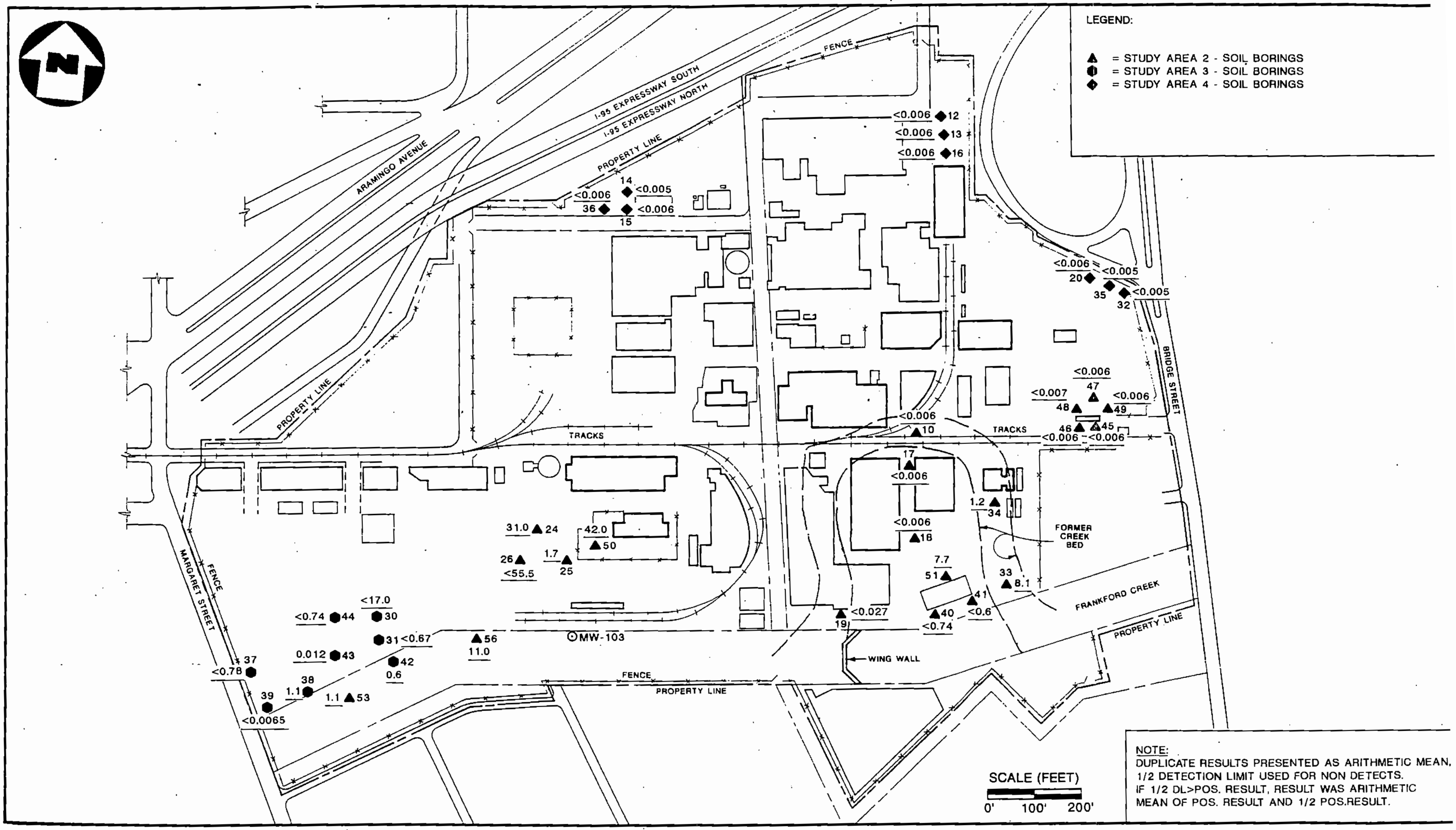
5.4 NATURE AND EXTENT OF CONTAMINATION

This section will focus on Phase I field observations and analytical data. Section 5.2.1 summarized qualitative observations from previous investigations. Plate 1 contains field observations from Study Area No. 2 borings.

The types of compounds detected are similar in the various SWMUs and the AOC in this study area. The distribution of several significant compounds is illustrated on Figures 5-1, 5-2, 5-3, and 5-4.

5.4.1 AOC-2: Naphthalene-Contaminated Soil

Naphthalene-like crystalline material was reported in two of three borings (41 and 51) at AOC-2, at an approximate depth of 3 feet (the thickness at boring no. 41 was estimated as 24 inches). Similar material was also reported in two borings from SWMU No. 42 (boring nos. 18 and 33) and in boring no. 55, indicating that the boundaries of the SWMUs/AOCs appear to overlap. LNAPL was not detected in AOC-2.



BENZENE CONCENTRATION IN SOIL (mg/kg)

ALLIED FIBERS FRANKFORD PLANT

FIGURE: 5-1

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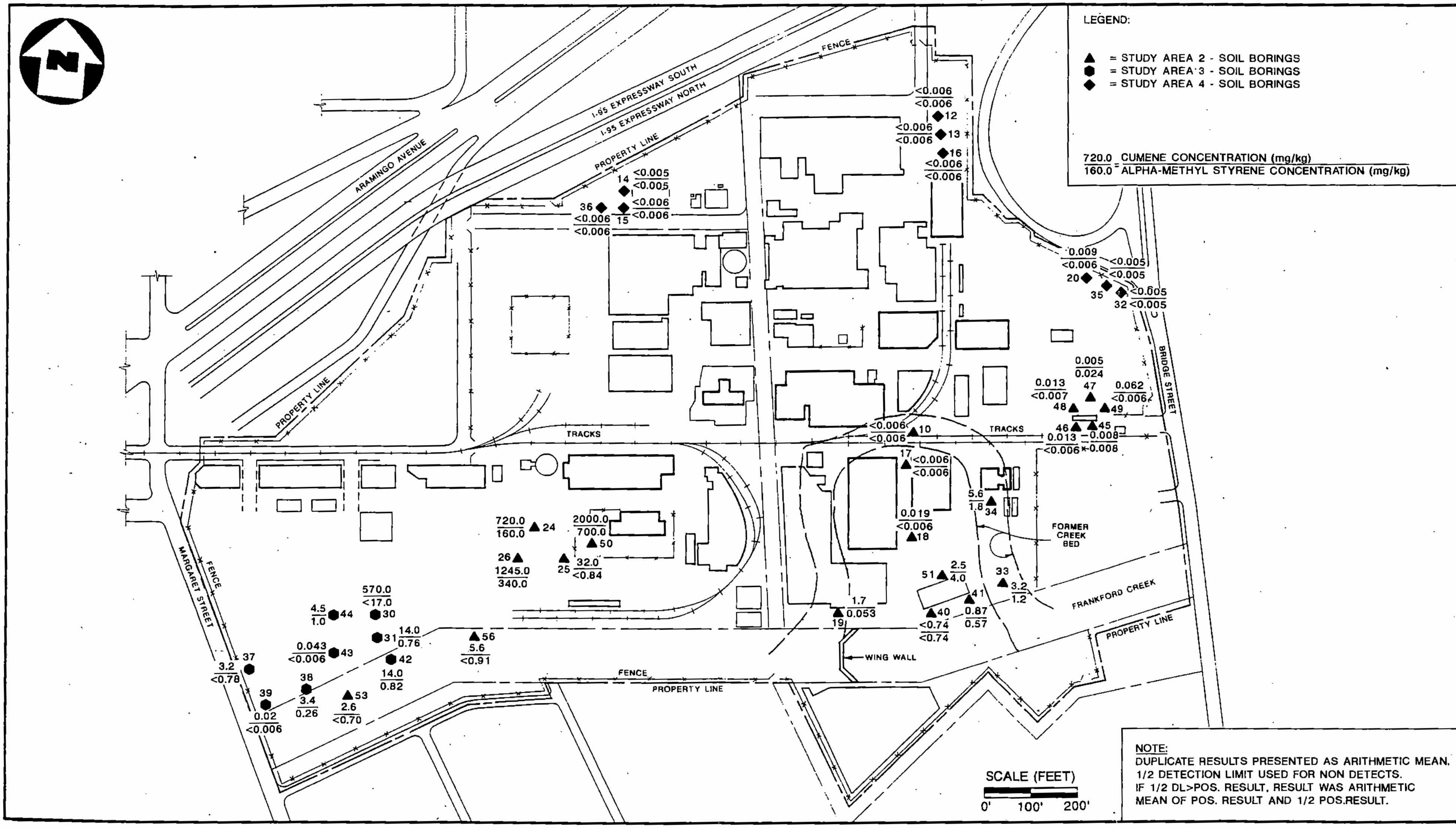

CONCENTRATION OF CUMENE AND ALPHA-METHYL STYRENE IN SOIL (mg/kg)

ALLIED FIBERS FRANKFORD PLANT

FIGURE: 5-2

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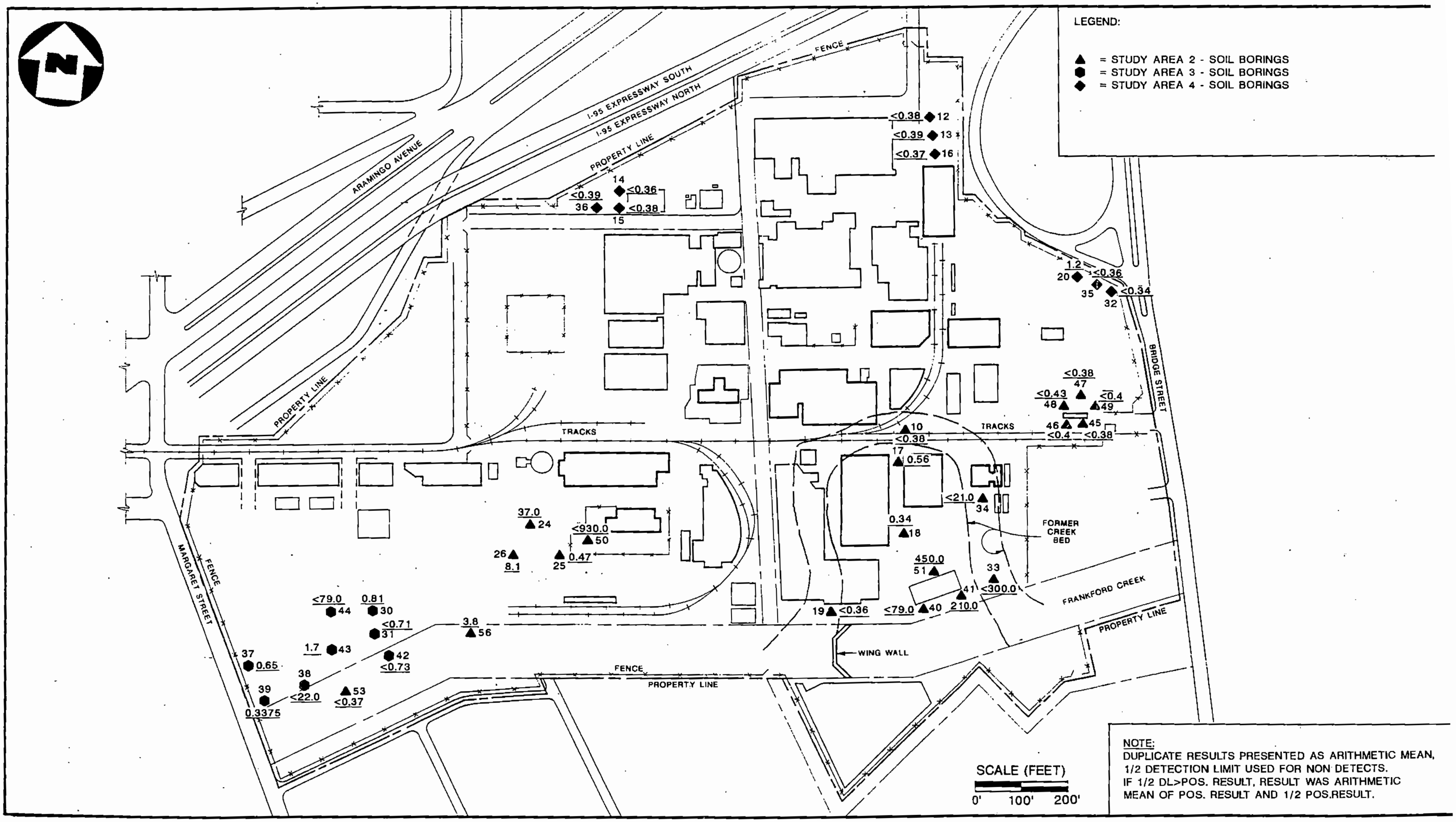

PHENOL CONCENTRATIONS IN SOIL (mg/kg)

ALLIED FIBERS FRANKFORD PLANT

FIGURE: 5-3

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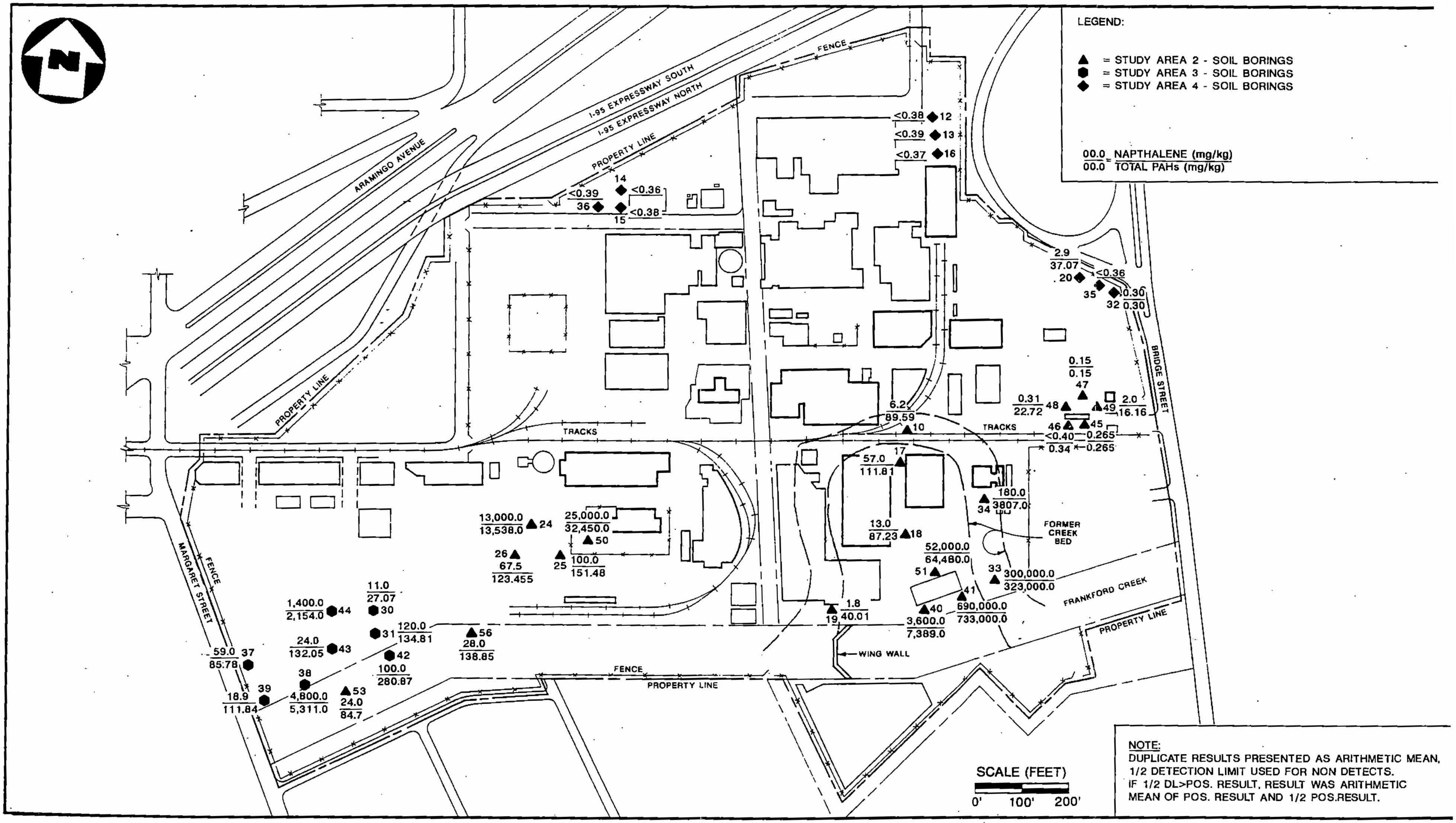

FIGURE: 5-4

NAPHTHALENE AND PAH CONCETRATIONS IN SOIL

ALLIED FIBERS FRANKFORD PLANT

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The occurrence and distribution of organic compounds detected in AOC-2 samples are summarized in Table 5-1; complete data are provided in Appendix A. Acetone, AMS, cumene, benzene, substituted benzenes, phenol, substituted phenols, PAHs, and phthalates were detected in subsurface soil. Naphthalene was detected at concentrations ranging as high as 69 percent (sample SO4103 was a crystalline material, and sample SO5103 appeared to be a mixture of crystalline material and fill). TICs included alkylbenzenes (including trimethylbenzenes), methylstyrene, substituted quinolines, PAHs (including methylnaphthalene and other substituted naphthalenes), phthalates, substituted pyridines, and substituted phenols, which can be associated with the history of production at the facility (NUS, 1991).

TOC content in the collected samples ranged from 2.6 percent to 36.6 percent. The material is considered to contain significant amounts of residue and fill rather than native soils; the TOC results are not considered indicative of naturally occurring organic carbon.

5.4.2 SWMU 11: Past Landfill Area A

Ash and coal debris were reportedly observed in SWMU 11 borings. TOC ranged from 0.15 percent to 3 percent.

LNAPL was not detected at SWMU No. 11. The occurrence and distribution of organic compounds detected in SWMU No. 11 soil samples are summarized in Table 5-1. It is apparent that the least amount of contamination in Study Area No. 2, both by frequency and concentration, was found in the samples from SWMU No. 11, which is the northeasternmost of the SWMUs/AOC in this study area. Compounds detected included AMS, cumene, benzene, substituted benzenes, phthalates, and PAHs, including naphthalene. TICs included alkylbenzenes (including trimethylbenzenes), methylstyrene, PAHs (including methylnaphthalene and other substituted naphthalenes), and phthalates, which can be associated with the history of production at the facility (NUS, 1991).

5.4.3 SWMU 12: Past Landfill Area B

Tar, oil, fill material, and naphthalene-like material were reportedly observed in SWMU No. 12 subsurface soil. The TOC content of SWMU No. 12 samples ranged from 0.9 percent to 24 percent.

TABLE 5-1
OCCURRENCE AND DISTRIBUTION OF ORGANIC COMPOUNDS IN SOIL AT STUDY AREA 2
ALLIED FRANKFORD PLANT
PHILADELPHIA, PENNSYLVANIA
(mg/kg)

Chemical	Area of Concern No. 2		SWMU No. 11		SWMU No. 12		SWMU No. 42	
	Frequency of Positive Detections	Range of Positive Detections	Frequency of Positive Detections	Range of Positive Detections	Frequency of Positive Detections	Range of Positive Detections	Frequency of Positive Detections	Range of Positive Detections
1,2-Dichloroethene	0/3	---	0/5	---	0/5	---	1/7	0.02
Acetone	1/3	41	0/5	---	0/5	---	0/7	---
Alpha-methyl styrene	2/3	0.57 to 4	2/5	0.0075 to 0.024	3/5	160 to 700	3/7	0.053 to 1.8
Cumene	2/3	0.87 to 2.5	5/5	0.005 to 0.062	5/5	5.6 to 2,000	5/7	0.019 to 3.2
Trichloroethene	0/3	---	1/5	0.01	0/5	---	0/7	---
4-Methyl-2-pentanone	0/3	---	0/5	---	0/5	---	1/7	1.8
Styrene	2/3	2.7 to 17	0/5	---	2/5	19 to 320	2/7	0.88 to 3.7
Chlorobenzene	0/3	---	0/5	---	1/5	2.0	0/7	---
Benzene	1/3	7.7	0/5	---	4/5	1.7 to 42	3/7	1.1 to 8.1
Toluene	2/3	2.7 to 23	1/5	0.008	4/5	2.1 to 160	3/7	0.004 to 200
Ethylbenzene	3/3	1.3 to 9.8	1/5	0.017	4/5	12 to 130	3/7	0.81 to 21
Xylenes	3/3	3.1 to 80	2/5	0.022 to 0.072	5/5	22 to 940	4/7	0.011 to 150
Benzoic acid	0/3	---	0/5	---	0/5	---	1/7	32
Phenol	2/3	210 to 450	0/5	---	4/5	0.47 to 37	2/7	0.34 to 0.57
2-Methylphenol	1/3	390	0/5	---	2/5	17 to 28	2/7	0.42 to 1.5
4-Methylphenol	2/3	200 to 1,300	0/5	---	3/5	0.975 to 76	2/7	1.0 to 1.5
2,4-Dimethylphenol	3/3	33 to 5,000	0/5	---	3/5	0.445 to 140	4/7	0.17 to 320
PAHs (minus naphthalene)	3/3	3,789 to 43,000	0/5	0.34 to 22.41	5/5	43.6 to 7,450	7/7	38.21 to 23,000
Naphthalene	3/3	3,600 to 690,000	3/5	0.15 to 2.0	5/5	28 to 25,000	7/7	1.8 to 300,000
Phthalates	0/3	---	1/5	0.48	1/5	1.5	6/7	0.48 to 270
TIC Benzenes	3/3	---	5/5	---	5/5	---	6/7	---
TIC PAHs	3/3	---	3/5	---	5/5	---	6/7	---
TIC Methyl styrene	3/3	---	0/5	---	2/5	---	2/7	---
TIC Phthalates	1/3	---	0/5	---	0/5	---	0/7	---
TIC Phenols	0/3	---	0/5	---	1/5	---	0/7	---

(Duplicate samples were averaged using 1/2 detection limit for non-detects.)

As discussed in Section 4.0, the LNAPL plume extends into the area of SWMU No. 12 and was found in four of the borings. The occurrence and distribution of organic compounds detected in SWMU No. 12 samples are summarized in Table 5-1. Compounds detected included AMS, cumene, styrene, benzene, substituted benzenes, phenol, substituted phenols, and PAHs. Although the samples from this SWMU were collected from the vadose zone, the cumene and AMS detected may represent residual contamination from a time in the past when the groundwater table (and LNAPL layer) was located closer to the surface, in the sampling horizon; there are no reported uses of cumene/AMS in the SWMU No. 12 vicinity. Naphthalene was detected up to 2.5 percent; this sample, from boring no. 50, appeared to be a mixture of fill and naphthalene-contaminated residue. This sample result supports the report that naphthalene-contaminated sludge was disposed in this area. TICs included alkylbenzenes (including trimethylbenzenes), methylstyrene, PAHs including methylnaphthalene and other substituted naphthalenes, biphenyl and biphenyl compounds, substituted pyridines, substituted phenols, and quinoline compounds, all of which may be associated with previous site operations (NUS, 1991).

5.4.4 SWMU 42: Former Creekbed

Oil stains and a tarry layer were observed in SWMU No. 42 subsoil. The TOC content of SWMU No. 42 samples ranged from 0.2 percent to 9 percent.

The occurrence and distribution of organic compounds in SWMU No. 42 are summarized in Table 5-1. Compounds detected included AMS, cumene, benzene, substituted benzenes, phenol, substituted phenols, phthalates, and PAHs, including naphthalene. Samples from this SWMU could not be clearly distinguished between creekbed fill samples and other fill samples, as discussed in Section 5.2.2.4. The compounds detected in SWMU No. 42 samples and the adjoining SWMU No. 12 and AOC-2 samples were similar, although concentrations and frequencies of detection were slightly less for SWMU No. 42 samples than for AOC-2 and SWMU No. 12 samples. TICs included alkylbenzenes (including trimethylbenzenes), PAHs (including methylnaphthalene and other substituted naphthalenes), biphenyl compounds, substituted benzoic acid, quinoline compounds, and methylstyrene.

5.5 CONTAMINANT FATE AND TRANSPORT

Compounds such as PAHs and phthalates are expected to migrate much more slowly in environmental media than styrene or benzene. Therefore, it is the volatile solvents and the substituted phenols that could serve as primary potential sources of groundwater contamination from the subsoil. Details on contaminant fate and transport can be found in Tables 2-1, 2-2, and 2-3 and in Section 2.3.

5.6 HEALTH AND ENVIRONMENTAL ASSESSMENT

Subsurface soil (rather than surface soil) was sampled because the soil at the site is covered by asphalt, gravel, or buildings. Therefore, direct contact with soil is not a feasible exposure pathway unless the soil is disturbed (e.g., during excavation). In such cases, on-site workers would be the potential receptors. Access restrictions prevent trespassing by unauthorized personnel. Deed restrictions, if placed, should prevent alternate land use in the future.

The potential exposure pathways for workers under the excavation scenario are dermal contact/absorption and incidental ingestion. Inhalation exposure to workers under these conditions falls under the jurisdiction of OSHA (EPA, May 1989). Personal protective equipment (PPE) and good health and safety practices in accordance with all applicable regulations are expected to preclude the potential direct-contact dermal and ingestion exposure pathways. For example, a realistic risk assessment cannot assume that hands would come in contact with soil (a typical assumption for worker exposure scenarios) when workers are actually gloved (which is the case at this site). The PPE and health and safety practices used during excavations at Allied are provided in Appendix F.

Groundwater contamination as a result of leachate generation from contaminated subsoil is considered to be a possibility. At this time, specific hydrogeologic parameters necessary to assess this pathway are unknown. Groundwater flow direction, velocity, etc. will be more accurately defined during Phase II to support characterization of this pathway. As discussed in Section 4.6, indirect exposure to groundwater contamination could conceivably result from discharge to surface water or sewer infiltration.

5.7 CONCLUSIONS AND RECOMMENDATIONS

5.7.1 Conclusions

Crystalline naphthalene-like material was encountered in the creekbed meander area in Boring Nos. 18, 33, 41, 51 and 55; as well as in Boring No. 50 in the central portion of the site. Figure 5-5 depicts the area where naphthalene materials were detected.

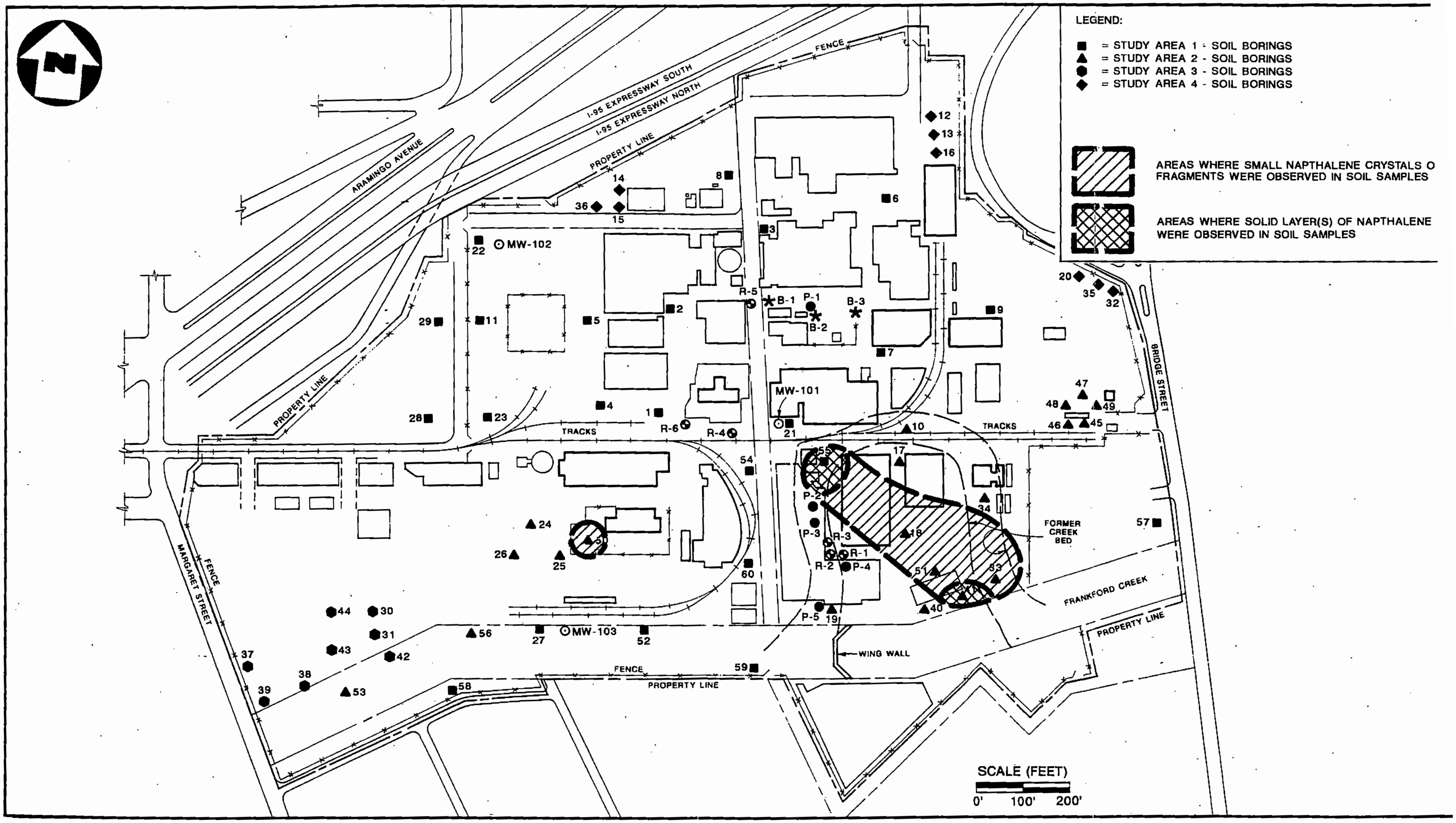

FIGURE: 5-5

VISUAL OBSERVATIONS OF NAPTHALENE CONTAMINATED SOIL

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Contaminated soils were detected in all of the SWMUs/AOCs making up Study Area No. 2. Significant contaminants detected during Phase I consist of past and present facility products and feedstocks, including cumene, naphthalene, benzene, phenol, cresols, and acetone. The least-contaminated site was SWMU No. 11; a "no further action" determination for this unit may be appropriate.

While contaminated soils/residues are present in Study Area No. 2, no completed exposure pathways were confirmed during Phase I. Potential direct contact exposures are ameliorated by the access restrictions and health and safety practices in place at the Frankford facility. While groundwater contamination would be expected to result from Study Area No. 2 soils/residues, it was not determined if any contaminated groundwater is actually leaving the site. (It could possibly all be contained by the existing recovery wells and sewer infiltration.)

5.7.2 Recommendations

Because the vadose zone soil contamination (see also Section 6.0) is relatively continuous throughout the facility, the area of contamination beneath the Allied Fibers Frankford Plant should be considered to be one Study Area/Corrective Action Management Unit (CAMU) for the remainder of RCRA corrective action activities.

The extent of groundwater contamination was not determined during the Phase I RFI. (It was not a Phase I objective.) This extent should be determined in subsequent RFI phases. A piezometer network should be installed prior to the installation of any additional monitoring wells, to minimize monitoring well placement/sampling expenses.

Based on the Phase I analytical results and visual observations, active groundwater remediation at the Allied Fibers Frankford Plant is not practicable. Subsequent investigations at the facility should concentrate on collecting sufficient information to evaluate the feasibility of a groundwater containment system augmented by natural flushing. Specific recommendations include confirming the continuity and low permeability of the silt-clay unit underlying the southern half of the site, as well as the conduct of more detailed aquifer tests. There does not appear to be a need for additional soil/fill sampling for facility characterization purposes.

The contamination detected in SWMU No. 11 should be evaluated further in Phase II once the groundwater flow regime is better understood, to assess whether a "no further action" determination for this unit is warranted.

6.0 STUDY AREA NO. 3

Study Area No. 3 consists of SWMU Nos. 19, 20, 21, and 30 (Past Dephenolizer I with associated Feed Tanks 12278, 12279, and 12280) and 49 (Naphthalene Tank Bottoms Area).

6.1 DESCRIPTION

6.1.1 SWMU Nos. 19, 20, 21, and 30: Past Dephenolizer I Area

SWMU No. 19, the Past Dephenolizer I, was a steam-stripping column used to treat approximately 89,000 gallons/day of wastewater. The wastewater reportedly contained an average of 30,000 to 40,000 parts per million (ppm) phenols and unspecified concentrations of sodium sulfate and acetone. The dephenolizer, feed tanks, and associated underground piping have been removed and the areas covered with gravel. The feed tank at SWMU No. 20 was reported to leak (Kearney, 1987). Refined naphthalene was reportedly stored in drums in the area of the feed tanks (NUS, 1991).

6.1.2 SWMU 49: Naphthalene Tank Bottoms Area

In this area, fewer than 200 cubic yards of naphthalene tank bottoms were reportedly spread, graded, and covered with stone (Flowers, 1990).

6.2 INVESTIGATION

6.2.1 Previous Investigations

No environmental sampling was conducted prior to the Phase I investigation.

6.2.2 RFI Phase I Investigations

Eight soil borings (30, 31, 37, 38, 39, 42, 43, and 44) were advanced in Study Area No. 3. One vadose zone sample from each boring was analyzed for the following parameters:

- TCL VOA
- TCL BNA
- AMS and cumene
- TOC

6.3 SITE CHARACTERISTICS

Soil boring nos. 30, 31, 37, 38, 39, 42, 43, and 44 were drilled to investigate SWMU Nos. 19, 20, 21, 30, and 49 in Study Area No. 3. Similar results were obtained from all these soil borings with regard to the geologic and hydrologic conditions encountered. Therefore, the geologic and hydrologic characteristics can be described for Study Area No. 3 as a whole rather than for individual SWMUs within the study area.

6.3.1 Geology

The fill deposits at Study Area No. 3 range from approximately seven to more than 12 feet thick (see Figure 3-5). The thickness of the fill deposits increases from northwest to southeast, toward the filled former channel of Frankford Creek. The fill in this area is composed primarily of sand, silt, clay, gravel, fragments of brick, rock and concrete, ashy material, and wood. Coal fragments, coal-tar-like residue, and an unidentified black tarry substance were present less frequently within the fill. The surface is covered by an approximately 6- to 12-inch-thick layer of crushed stone with rock, brick, and concrete fragments. The silt-clay lithologic unit (see Figure 3-7) underlies the fill deposits throughout Study Area No. 3. Descriptions from deep boring no. 39 indicate that the silt-clay unit extends to a depth of about 34 feet and is underlain by approximately six feet of the lower sand and gravel lithologic unit (cross-section B-B' -- see Figure 3-4). Saprolite and bedrock are found underlying the lower sand and gravel unit.

6.3.2 Hydrogeology

The depth to the saturated zone in the Study Area No. 3 soil borings ranges from approximately 3 to 5 feet below the surface. The shallow aquifer in this area occurs entirely within the fill deposits. Hydraulic conductivity measurements in MW-103 (see Section 3.5.2.3) indicate that the shallow aquifer has a relatively high permeability but is less permeable than the shallow aquifer composed of the upper sand and gravel unit. The underlying silt-clay unit, where present, is expected to act as a confining layer to the downward movement of groundwater from the shallow aquifer. Hydrogeologic data in Study Area No. 3 are insufficient to determine or estimate the elevation and flow direction of the shallow groundwater.

6.4 NATURE AND EXTENT OF CONTAMINATION

These SWMUs will be addressed together as one study area, because the SWMUs were adjacent and field observations and chemical results were similar. A tarry layer, oil, and demolition debris were reported in field observations. Field observations from Study Area No. 3 borings are summarized on Plate 1. The TOC content of the study area samples ranged from 1 percent to 4 percent.

LNAPL was not detected in Study Area 3. The occurrence and distribution of chemicals detected in Study Area No. 3 unsaturated soil samples are summarized in Table 6-1. It can be seen that cumene (up to 570 mg/kg) and naphthalene (up to 4,800 mg/kg) and other PAHs (up to 754 mg/kg) were detected in all samples. The highest naphthalene concentration was detected in the sample from boring no. 38; the highest cumene concentration was detected in the sample from boring no. 30. The naphthalene detected in the boring no. 38 sample could be a result of the reported spreading of naphthalene tank bottoms in this area. Cumene (and AMS) were not reportedly used in the vicinity of Study Area No. 3. The detected cumene could be a result of underlying groundwater contamination and a fluctuating groundwater table. Substituted benzenes and substituted phenols were among the other chemicals detected. The distribution of several significant detected compounds is illustrated on Figures 5-1, 5-2, 5-3, and 5-4.

It should be noted that the highest detected phenol concentration in Study Area No. 3 samples was only 1.7 mg/kg, despite its reported past usage (and leakage) in this area.

TICs detected included alkylbenzenes (including trimethylbenzenes), PAHs (including methylnaphthalene and other substituted naphthalenes), substituted phenols, and methylstyrene, which can be associated with the history of production at the facility (NUS, 1991).

6.5 CONTAMINANT FATE AND TRANSPORT

The fate-related properties of chemicals detected in Study Area No. 3 are summarized in Tables 2-1, 2-2, and 2-3 and discussed in Section 2.3. The volatile solvents such as benzene and toluene are expected to be more mobile in soil and groundwater than PAHs and phthalates. All the detected compounds, with the exception of the phthalates, may be susceptible to biodegradation (see Section 2.3).

TABLE 6-1
OCCURRENCE AND DISTRIBUTION OF ORGANIC COMPOUNDS AT STUDY AREA 3
ALLIED FIBERS FRANKFORD PLANT
PHILADELPHIA, PENNSYLVANIA
(All data in mg/kg)

Chemical	Frequency of Positive Detections	Range of Positive Detections
Alpha-methyl styrene	4/8	0.26 to 1.0
Cumene	8/8	0.02 to 570
Benzene	3/8	0.012 to 1.1
Toluene	5/8	0.0155 to 3.5
Ethylbenzene	5/8	0.0075 to 6.3
Xylenes	6/8	0.0335 to 35
PAHs (minus naphthalene)	8/8	16.07 to 754
Naphthalene	8/8	11 to 4,800
Phthalates	4/8	0.96 to 20
Phenol	4/8	0.3375 to 1.7
Styrene	2/8	1.1 to 1.45
2-Methylphenol	1/8	0.75
4-Methylphenol	3/8	0.6525 to 0.96
2,4-Dimethylphenol	2/8	0.6825 to 2.7
TIC Methyl styrene	4/8	---
TIC Benzenes	8/8	---
TIC PAHs	8/8	---

Arithmetic means were used for duplicate samples, using 1/2 detection limit for non-detects; when 1/2 detection limit was greater than the positive result, the average of the positive result and 1/2 the positive result was used.

6.6 HEALTH AND ENVIRONMENTAL ASSESSMENT

Potential receptors and pathways for Study Area No. 3 soil contaminants are the same as those discussed in Section 5.6 for Study Area No. 2. In Phase II, Study Area No. 3 soil contamination will be assessed in the same manner as for Study Area No. 2 soil contamination.

6.7 CONCLUSIONS AND RECOMMENDATIONS

6.7.1 Conclusions

Contaminated soils were identified in Study Area No. 3. Significant contaminants detected during Phase I consist of past and present facility products and feedstocks, including cumene, naphthalene, benzene, phenol, and cresols. The highest naphthalene concentration detected was 0.48 percent.

While contaminated soils are present in Study Area No. 3, no completed exposure pathways were confirmed during Phase I. Potential direct contact exposures are mitigated by the access restrictions and health and safety practices in place at the Frankford facility. While groundwater contamination would be expected to result from Study Area No. 3 soils, it was not determined if any contaminated groundwater is actually leaving the site. (It could possibly all be contained by the existing recovery wells and sewer infiltration.)

6.7.2 Recommendations

Because the vadose zone soil contamination (see also Section 5.0) is relatively continuous throughout the facility, the area of contamination beneath the Allied Fibers Frankford Plant should be considered to be one Study Area/Corrective Action Management Unit (CAMU) for the remainder of RCRA corrective action activities.

The extent of groundwater contamination was not determined during the Phase I RFI. (It was not a Phase I objective.) In subsequent RFI phases, this extent should be determined. A piezometer network should be installed and water levels measured prior to the installation of any additional monitoring wells, to minimize monitoring well placement/sampling expenses.

Active groundwater remediation at the Allied Fibers Frankford Plant is not practicable, based on the Phase I analytical results and visual observations. Future investigations at the facility should concentrate on collecting sufficient information to evaluate the feasibility of a groundwater containment system augmented by natural flushing. Specific recommendations include confirming the continuity and low permeability of the silt-clay unit underlying the southern portion of the site, as well as completion of more detailed aquifer tests. Additional soil sampling for facility characterization purposes do not appear to be necessary.

7.0 STUDY AREA NO. 4

7.1 DESCRIPTION

Study Area No. 4 consists of three SWMUs: Nos. 2 (Nonhazardous Drum Storage Area), 3 (Past Drum Storage Facility C), and 5 (Past Drum Storage Facility E). SWMU Nos. 2 and 3 are located in the northern part of the site; SWMU 5 is located in the northeastern part of the site (see Figure 2-1).

7.1.1 SWMU No. 2: Nonhazardous Drum Storage Area

The Nonhazardous Drum Storage Area consisted of a paved area formerly used to store drummed hazardous and nonhazardous waste. These wastes may have included activated carbon sweepings, empty sample bottles, and ion exchange resins, which may have contained trace amounts of cumene, phenol, acetone, and AMS. This unit underwent RCRA closure and is currently used to store drummed nonhazardous waste and empty drums (NUS, 1991; Kearney, 1987).

7.1.2 SWMU No. 3: Past Drum Storage Facility C

This facility was reported to consist of a 30- by 40-foot open hazardous waste drum storage area with a gravel base. This unit was studied because of the possibility that spilled wastes could have contaminated soil and/or groundwater. Storage was discontinued prior to 1980 (NUS, 1991; Kearney, 1987).

7.1.3 SWMU No. 5: Past Drum Storage Facility E

This facility was reported to be a 340- by 40-foot open storage area with a gravel base. The wastes stored on site were reported to consist of 300 to 400 drums of paint waste, which may have contained phenol, acetone, and AMS. Currently, the area is partially paved (NUS, 1991; Kearney, 1987).

7.2 INVESTIGATION

7.2.1 Previous Investigations

No environmental samples were collected in Study Area No. 4 prior to the Phase I RFI investigation.

7.2.2 RFI Phase I Investigations

7.2.2.1 SWMU No. 2: Nonhazardous Drum Storage Area

Three soil borings (14, 15, and 36) were advanced in this area. One unsaturated soil sample from each of the borings was analyzed for the following parameters:

- TCL VOA
- TCL BNA
- AMS and cumene
- TOC
- Grain size (one sample)

7.2.2.2 SWMU 3: Past Drum Storage Facility C

Three soil borings (12, 13, and 16) were drilled in this area. One unsaturated soil sample from each of the borings was analyzed for the following parameters:

- TCL VOA
- TCL BNA
- AMS and cumene
- TOC

7.2.2.3 SWMU 5: Past Drum Storage Facility E

Three soil borings (20, 32, and 35) were drilled in this area. One unsaturated soil sample from each of the borings was analyzed for the following parameters:

- TCL VOA
- TCL BNA
- AMS and cumene
- TOC

Boring no. 9, which was not sampled for the purpose of chemical analysis but was used for LNAPL delineation, will also be used for qualitative field observations because it was obtained in the vicinity of SWMU 5.

7.3 SITE CHARACTERISTICS

7.3.1 Geology

Soil boring nos. 14, 15, and 36 were drilled to investigate SWMU No. 2, the Nonhazardous Waste Drum Storage Area, in Study Area No. 4. The fill deposits at SWMU No. 2 are approximately three to four feet thick (see Figure 3-5) and consist primarily of silt, clay, sand, and some rock and brick fragments. The upper six inches consist of asphalt over a crushed stone base. The fill deposits are underlain by the upper sand and gravel lithologic unit, which is underlain by saprolite and bedrock at an approximate depth of 27.5 feet (Cross-section A-A' -- see Figure 3-3). The silt-clay and the lower sand and gravel lithologic units were not identified in the area of SWMU No. 2.

Boring nos. 12, 13, and 16 were drilled to investigate SWMU No. 3, Past Drum Storage Facility C, in Study Area No. 4. The fill deposits are approximately three to four feet thick at SWMU No. 3 (see Figure 3-5) and consist primarily of sand, silt, and clay, with brick, rock, and coal fragments. The surface is covered by a layer of crushed-stone gravel about 6 to 12 inches thick. The fill deposits are underlain by the upper sand and gravel lithologic unit. The three borings at SWMU No. 3 reached total depths of 11 to 12.5 feet, still within the upper sand and gravel. The geology below this depth is unknown. It is inferred from the information presented in Section 3.4 that saprolite and bedrock occur at an approximately depth of 30 feet, underlying the upper sand and gravel, and that the silt-clay and the lower sand and gravel lithologic units are not present beneath SWMU No. 3.

Boring nos. 20, 32, and 35 were drilled to investigate SWMU No. 5, Past Drum Storage Area Facility E, in Study Area No. 4. The fill deposits at SWMU No. 5 are approximately 2 to 3 feet thick (see Figure 3-5) and consist primarily of sand, silt, and clay, with some brick and rock fragments, pebbles, and gravel. The surface is covered by a layer of crushed-stone gravel or asphalt, about 6 to 12 inches thick. The fill deposits are underlain by the upper sand and gravel lithologic unit. The three soil borings at SWMU No. 5 reached total depths of approximately 9 feet, still within the upper sand and gravel. The geology below this depth is unknown. From the information presented in Section 3.4, it is inferred that the depth to saprolite and bedrock is approximately 30 to 35 feet; however, it is not possible to determine if the silt-clay or the lower sand and gravel lithologic units are present in the subsurface at SWMU no. 5.

7.3.2 Hydrogeology

The depth to groundwater in boring nos. 14, 15, and 36 at SWMU No. 2 is approximately 13 to 14 feet below the surface. The elevation of the water table is estimated to be approximately 4.5 to 5.0 feet above mean sea level (see Figure 3-5). The lithologic descriptions and grain-size analyses from the upper sand and gravel unit and the hydraulic conductivity measured in nearby monitoring well MW-102 suggest that the sediments in this area are highly permeable. Contours of groundwater elevation indicate that the direction of shallow groundwater flow is generally toward the south.

The depth to groundwater in boring nos. 12, 13, and 16 at SWMU No. 3 is approximately 10 to 12 feet below the surface. Geologic and hydrologic information on the upper sand and gravel unit suggests that the shallow aquifer here is highly permeable. It is not possible to accurately estimate the elevation or flow direction of shallow groundwater at SWMU No. 3 from the information currently available.

The depth to groundwater in boring nos. 20, 32, and 35 at SWMU No. 5 is approximately 7.5 to 9 feet below the surface. Geologic and hydrologic information on the upper sand and gravel unit suggests that the shallow aquifer here is highly permeable. It is not possible to accurately estimate the elevation or flow direction of shallow groundwater at SWMU No. 5 from the information currently available.

7.4 NATURE AND EXTENT OF CONTAMINATION

Study Area No. 4 soil boring field observations are summarized on Plate 1. The results of the Phase I chemical analyses of Study Area No. 4 soil samples are summarized in Table 7-1. The distribution of several significant chemicals is illustrated on Figures 5-1, 5-2, 5-3, and 5-4.

7.4.1 SWMU No. 2: Nonhazardous Drum Storage Area

Field observations found no LNAPL, stains, or waste material in the sandy silt/clay in this area. Only phthalates were detected in the SWMU No. 2 soil samples (up to 0.69 mg/kg). Bis(2-ethylhexyl) phthalate (DEHP) was not detected in SWMU No. 2 soil samples.

TABLE 7-1
OCCURRENCE AND DISTRIBUTION OF ORGANIC COMPOUNDS IN STUDY AREA NO. 4 SOIL SAMPLES
ALLIED FRANKFORD
PHILADELPHIA, PENNSYLVANIA
(All data in mg/kg)

Chemical	SWMU No. 2		SWMU No. 3		SWMU No. 5	
	Frequency of Positive Detections	Range of Positive Detections	Frequency of Positive Detections	Range of Positive Detections	Frequency of Positive Detections	Range of Positive Detections
Phthalates	1/3	0.690	1/3	0.730	1/3	4.6
PAHs (minus naphthalene)	0/3	---	1/3	0.825	1/3	34.17
Naphthalene	0/3	---	0/3	---	2/3	0.3 to 2.9
Carbon Disulfide	0/3	---	0/3	---	1/3	0.015
Cumene	0/3	---	0/3	---	1/3	0.009
Phenol	0/3	---	0/3	---	1/3	1.2
N-nitrosodiphenylamine	0/3	---	0/3	---	1/3	0.31
TIC PAHs	0/3	---	0/3	---	1/3	---
TIC Substituted Benzenes	0/3	---	0/3	---	1/3	---
TIC Phthalates	0/3	---	1/3	---	0/3	---

TIC = Tentatively identified compound
PAHs = Polycyclic aromatic hydrocarbons

7.4.2 SWMU No. 3: Past Drum Storage Facility C

Field observations found the subsoil to be a silty clay; stains and odors were not observed. LNAPL was not detected. The following chemicals were positively detected in soil samples: PAHs up to 0.825 mg/kg and phthalates confidently identified up to 0.73 mg/kg. Naphthalene and DEHP were not detected. Other phthalates were also tentatively identified.

7.4.3 SWMU No. 5: Past Drum Storage Facility E

It was observed in the field that soil in this area consisted of sand and silt, clay, and gravel fill. LNAPL was not detected. Two of the samples (from boring nos. 32 and 35) yielded minimal contamination (carbon disulfide at 0.015 mg/kg; naphthalene at 0.3 mg/kg). In the boring no. 20 sample, several organic compounds were detected: cumene (0.009 mg/kg), phenol (1.2 mg/kg), PAHs (37.07 mg/kg, including naphthalene at 2.9 mg/kg), n-nitrosodiphenylamine (0.31 mg/kg), and phthalates (4.6 mg/kg). Tentatively identified compounds included substituted naphthalenes, eicosane, and substituted benzenes, which may be associated with the site history (NUS, 1991). A naphthalene odor was reported in nearby boring no. 9, which was not sampled for chemical analysis.

Because contamination was greatest in the sample that was described as fill, the possibility exists that the fill may be the source of contamination in this area, as opposed to the drum storage facility.

7.5 CONTAMINANT FATE AND TRANSPORT

Phthalates and PAHs are relatively nonmobile in the environment. As can be seen in Table 2-1, the K_{OC}s of these compounds are relatively high, indicating strong tendencies to adsorb onto organic carbon in soil. Their solubilities in water are very low, indicating little potential for transport by infiltrating precipitation or migration via groundwater. Cumene and phenol can be somewhat mobile in the environment and are more likely to migrate in environmental media.

7.6 HEALTH AND ENVIRONMENTAL ASSESSMENT

7.6.1 SWMU 2: Nonhazardous Drum Storage Area

The same pathways will be considered in Phase II for this SWMU as those described in Section 4.6. It is likely that this SWMU will be eligible for a "no further action" determination, due to the low frequency, low concentrations, and nature of compounds detected.

7.6.2 SWMU No. 3: Past Drum Storage Facility C

Both PAHs and phthalates are common environmental contaminants. PAHs are found in coal and tar and organic combustion products; therefore, they are extremely common near paved surfaces (Casarett and Doull, 1986). PAHs can also be naturally occurring up to approximately 10 mg/kg (Dragun, 1988). Phthalates are noted for their ubiquity in the environment and their low acute and low chronic toxicity (Casarett and Doull, 1986). The exception is DEHP, which is classified as a Group B2 carcinogen (EPA, January 1991). DEHP was not detected in SWMU No. 3 soil.

The same pathways will be considered in Phase II for this SWMU as those described in Section 4.6. It is likely that this SWMU will be eligible for a "no further action" determination, due to the low frequency, low concentrations, and nature of compounds detected.

7.6.3 SWMU No. 5: Past Drum Storage Facility E

Both PAHs and phthalates are common environmental contaminants. PAHs are found in coal and tar and organic combustion products; therefore, they are extremely common near paved surfaces (Casarett and Doull, 1986). PAHs can also be naturally occurring up to approximately 10 mg/kg (Dragun, 1988). Phthalates are noted for their ubiquity in the environment and their low acute and low chronic toxicity (Casarett & Doull, 1986). The exception is DEHP, which is classified as a Group B2 carcinogen (EPA, January 1991).

The same pathways will be considered in Phase II for this SWMU as those described in Section 4.6. This SWMU may also be found to warrant a "no further action" determination.

7.7 CONCLUSIONS AND RECOMMENDATIONS

7.7.1 Conclusions

Only trace amounts of contamination were detected in soil samples from the SWMUs making up Study Area No. 4. Contaminants detected during Phase I included phthalates and PAHs, both of which are ubiquitous.

A "no further action" determination appears to be warranted for SWMU Nos. 2 and 3, and may be appropriate for SWMU No. 5. No completed exposure pathways were confirmed during Phase I. Potential direct contact exposures are ameliorated by the access restrictions and health and safety practices in place at the Frankford facility. Because PAHs and phthalates strongly bind to soils, significant groundwater contamination would not be expected to result from the soil contaminant levels detected during Phase I.

7.7.2 Recommendations

The shallow groundwater flow direction(s) in Study Area No. 4 were not determined with certainty during the Phase I RFI. The directions should be determined during RFI Phase II, to allow a complete risk assessment for these units. A piezometer network should be utilized to determine the flow direction(s), to minimize monitoring well placement/sampling expenses.

Once groundwater flow direction(s) beneath Study Area No. 4 have been established, SWMU Nos. 2, 3, and 5 should be evaluated further to assess whether "no further action" determinations for these unit are warranted. If, based on this assessment, some of the Study Area No. 4 vadose zone soil contamination is determined to present a threat to human health and/or the environment, this area of contamination should be combined with other contaminated units to form one Study Area/Corrective Action Management Unit (CAMU) for the remainder of RCRA corrective action activities.

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